April 22, 2015

To: J. N. McKamy Manager, US DOE NCSP
From: D. G. Erickson, Deputy Chair, US DOE NCSP CSSG dge

Subject: CSSG Tasking 2015-01 Response

In Tasking 2015-01 a subgroup of the Criticality Safety Support Group (CSSG) was requested to support the NNSA Central Technical Authority with guidance/interpretation on a query from the Uranium Processing Facility Project query related to their Safety Design Strategy and path forward.

The team consisted of the following members:

D. G. Erickson (lead)
D. K. Hayes
T. P. McLauglin
J. M. McKamy (NA-511, CSSG Emeritus)
C. H. Keilers (NA-511)

The attached CSSG response was reviewed by the entire CSSG. Comments were incorporated into the final version of the response that is attached to this memo.

cc: CSSG Members
M. Dunn
A. N. Ellis
L. Scott
C. H. Keilers (NA-511)

Attachment 1: Response to CSSG Tasking 2015-01
Attachment 2: Approved Tasking 2015-01

Attachment 1: Tasking 2015-01 UPF CTA Interpretation Response
April 22, 2015

Executive Summary

In Tasking 2015-01 (Attachment 2) the CSSG was requested review, and provide responses to the NNSA CTA, to questions posed by the Uranium Processing Facility (UPF) project regarding their Safety Design Strategy and path forward. The team identified a recently completed Tasking (2015-04) that provided a previously developed response to a question relating to DOE-STD-1020-2012 that essentially answered one of the questions.

Based on the review/response provided by the CSSG, the CSSG concurs with the positions taken by the UPF project.

Discussion

The CSSG was tasked with addressing the first three of four questions posed by the UPF project to NPO (see attachment to approved Tasking, included as Attachment 2, for UPF letter). The responses to those questions are provided below. As necessary/applicable, the bases for those responses are also provided.

Question 1: The UPF Project is using the informal interpretation of section 2.3.7 from DOE-STD-1020-2012 *Natural Phenomena Hazards Analysis and Design Criteria for DOE Facilities* as currently documented in the project UPF Safety Design Strategy (SDS) to determine the Natural Phenomena Hazard Design Category (NDC) for each of the UPF structures. The project requests a formal NNSA CTA interpretation to DOE-STD-1020-2012 in support of the project's current design efforts.

Response: The response to CSSG Tasking 2015-04, *DOE-STD-1020 Nexus to Criticality Safety*, addresses this question. The following points emphasize some of the important concepts from that response.

- ***Qualitative engineering judgment*** [emphasis added] is sufficient to evaluate those process conditions initiated by a credible NPH event, in accord with the ANSI/ANS-8.1 process analysis requirement.

- The intent is that if there is an SSC relied upon for criticality safety and the NPH initiated failure of that SSC alone will, ***based on sound engineering judgment*** [emphasis added], directly and clearly lead to a criticality event, then that SSC will be designed to NDC-3.

- It is often ***a matter of engineering judgment*** [emphasis added] to determine whether one or more SSCs should be considered as failing unconditionally, given the first failure. In all cases dealing with design basis NPH initiators, ***qualitative engineering judgment*** [emphasis added], amenable to peer review, is sufficient to fulfill the ANSI/ANS-8.1 process analysis requirement.

Question 2: Attachment 2 to DOE Order 420.1C, Chapter I, Section 3(b)(11) cites the need to integrate design requirements from the various disciplines. Attachment 2, Chapter II, Section 3(c)(2)(b) requires automatic suppression throughout the facility. Attachment 2, Chapter III, Section 3(g) notes that NCS needs to provide firefighting guidance for moderation controlled areas. The UPF project intends on restricting or eliminating sprinkler coverage in certain moderation controlled areas to satisfy NCS requirements. Does this NCS control strategy meet DOE Order 420.1 C or will an exemption be required?

Response: DOE Order 420.1C requires automatic fire suppression throughout facilities when required by the safety basis; when significant life safety hazards exist; when fire may cause unacceptable mission or program interruption; when maximum possible fire loss exceeds $5 million; or when facility area exceeds 5,000 sq ft (Chapter II, Section 3.c.(2)(c)). If this requirement is not met, then the Order requires an exemption be submitted in accordance with DOE O 251.1C, (Reference (6)).

However, though water based fire suppression is the usual method utilized, the Order does not prescribe the method of fire suppression. Many other, non-water based, fire suppression systems could be utilized. If the UPF project determines that control of moderation, e.g., water, is necessary, then alternative methods may be utilized. This would also have impact on manual firefighting efforts. In those cases NCS will need to interface with the fire protection program and provide appropriate guidance.

If it is determined that there are no acceptable alternate fire suppression methods, then an exemption to the Order is required.

Question 3: Attachment 2 to DOE Order 420.1C, Chapter III, Section 3(f) requires the facility to be subcritical for all design basis events including NPH events. DOE-STD-1020-2012 states that an NDC-3 event is a credible event. However, Section 2.3.7 also states that a criticality accident is to be treated the same as any radiological event in accordance with DOE-STD-1189, Appendix A. For the UPF project, the dose consequences result in an SDC-2 design basis seismic event. The UPF project is interpreting DOE-STD-1020-2012, Section 2.3.7, to be that the "design basis event" for a NPH initiated criticality accident is defined by DOE-STD-1189-2008, Appendix A and that NCS SSCs are to be assessed against NDC-3 criteria for single contingency vulnerabilities that may necessitate a select number of SSCs to be assigned to NDC-3 (similar to a beyond design basis event except there is no cost benefit evaluation). Is the UPF project's interpretation correct or should all NCS NPH design basis events be NDC-3 events?

Response: The CSSG previously considered criticality safety in design relative to NPH in Taskings 2010-01 (Rev.1) *Balanced Technical Approaches for Addressing Potential Seismically Induced Criticality Accidents in New Facility Design*, 2011-03 *CSSG Response to DNFSB Staff Member on CSSG Position in Regards to Seisemic Design*, 2011-04 *CSSG Review of the UPF Facility Position on Criticality Safety in Regards to Seismic Design*, and 2015-04 *DOE-STD-1020 Nexus to Criticality Safety*. We refer the reader to this entire body of work for a more comprehensive understanding of the issues involved from a criticality safety perspective. The conclusion of Tasking 2010-01 (Rev.1) is relevant to this response.

Consistent with the response to Question 1, for SSCs relied on for criticality safety, the design basis NPH events are established in the same way that they are for all other radiological hazards, based on consequences alone, using the DOE-STD-1189 Table A-1. This would generally limit the design basis event to an NDC level of NDC-1 or NDC-2. In addition to the NDC, an associated limit state is established based on what is needed to perform the safety function. ***Qualitative engineering judgment*** [emphasis added] of the credibility of specific criticality accident scenarios is sufficient to evaluate those process conditions initiated by a credible NPH event, in accord with the ANSI/ANS-8.1 process analysis requirement and documented in process-specific criticality safety evaluations.

There is an exception to the general rule of treating SSCs relied upon for criticality safety like those relied on for other radiological hazards. The exception should be a very rare circumstance that should be avoided when designing facilities. The exception is stated in two different ways in DOE-STD-1020-2012, Sect. 2.3.7, first in terms of contingencies and second in terms of SSC failures. The intent is that if there is an SSC relied upon for criticality safety and the NPH initiated failure of that SSC alone will, ***based on sound engineering judgment*** [emphasis added], directly and certainly lead to a criticality event, then that SSC will be designed to NDC-3. (Note that this would require DOE approval in accordance with DOE Order 420.1C, Chapter III.)

Therefore, the CSSG reiterates it's concurrence with the UPF Project's interpretation.

CSSG TASKING 2015-01
Date Issued: April 01, 2015

Task Title: ***Support CTA Interpretation regarding the UPF SDS***

Task Statement:

Per the attached letter, COT-NNSA-YSO-PM-801768-A781, the CSSG is requested to support the NNSA Central Technical Authority with guidance/interpretation on the following:

- The UPF Project is using the informal interpretation of section 2.3.7 from DOE-STD-1 020-2012 *Natural Phenomena Hazards Analysis and Design Criteria for DOE Facilities* as currently documented in the project UPF Safety Design Strategy (SDS) to determine the Natural Phenomena Hazard Design Category (NDC) for each of the UPF structures. The project requests a formal NNSA CTA interpretation to DOE-STD-1020-2012 in support of the project's current design efforts.
- Attachment 2 to DOE Order 420.1C, Chapter I, Section 3(b)(11) cites the need to integrate design requirements from the various disciplines. Attachment 2, Chapter II, Section 3(c)(2)(b) requires automatic suppression throughout the facility. Attachment 2, Chapter III, Section 3(g) notes that NCS needs to provide firefighting guidance for moderation controlled areas. The UPF project intends on restricting or eliminating sprinkler coverage in certain moderation controlled areas to satisfy NCS requirements. Does this NCS control strategy meet DOE Order 420.1 C or will an exemption be required?
- Attachment 2 to DOE Order 420.1C, Chapter III, Section 3(f) requires the facility to be subcritical for all design basis events including NPH events. DOE-STD-1020-2012 states that an NDC-3 event is a credible event. However. Section 2.3.7 also states that a criticality accident is to be treated the same as any radiological event in accordance with DOE-STD-1189, Appendix A. For the UPF project, the dose consequences result in an SDC-2 design basis seismic event. The UPF project is interpreting DOE-STD-1020-2012, Section 2.3.7, to be that the "design basis event" for a NPH initiated criticality accident is defined by DOE-STD-1189-2008, Appendix A and that NCS SSCs are to be assessed against NDC-3 criteria for single contingency vulnerabilities that may necessitate a select number of SSCs to be assigned to NDC-3 (similar to a beyond design basis event except there is no cost benefit evaluation). Is the UPF project's interpretation correct or should all NCS NPH design basis events be NDC-3 events?

There is 'disconnect' in the current 'informal' NNSA CTA guidance whereby 'qualitative engineering judgement' was used in giving out the seismic grading criteria, but it's not allowed when doing criticality safety evaluations for the 8.1 and 8.19 requirements for the extreme NPH events. The regulatory relief is to allow more qualitative arguments to be made for extreme NPH events that the processes should remain subcritical and can meet the DCP based on those arguments. Evacuation could be considered as 'defense in depth' in case something much worse than expected/evaluated happens.

Format of the response will be provided.

Couch in terms of compliance with existing orders and standards.

Resources:

CSSG Task 2015-01 Team Members:

- D. Erickson (Team Leader)
- D. Hayes
- T. McLaughlin
- J. McKamy (NA-511, CSSG Emeritus)
- C. Keilers (NA-511)

Contractor CSSG members of the team will use their FY15 NCSP CSSG support funding as appropriate; DOE CSSG members of the team will utilize support from their site offices. It is up to the team members to utilize other expertise, or include other interested parties, as can be made available to support the tasking, without incurring additional CSSG expenses. No travel is anticipated to be necessary to support this tasking.

Task Deliverables:

1. CSSG Subgroup to hold task 'kickoff' telecom by 04/8/2015
2. CSSG Subgroup to provide draft guidance/interpretation to full CSSG for review: 04/15/2015
3. Full CSSG to provide review comments to Task Team Leader: 04/20/2015
4. CSSG Subgroup to provide finalized guidance/interpretation to NCSP Manager: 04/22/2015

Task Completion Date: 04/22/2015

Signed: JN McKamy 4/1/2015

Jerry N. McKamy, Manager US DOE NCSP
Office of the Chief of Defense Nuclear Safety, NA-511

U.S. Department of Energy
NNSA Production Office
Post Office Box 2050
Oak Ridge, Tennessee 37831-8009

March 23, 2015

MEMORANDUM FOR: JAMES J. MCCONNELL
ASSOCIATE ADMINISTRATOR FOR
SAFETY, INFRASTRUCTURE AND OPERATIONS

FROM: STEVEN C. ERHART
MANAGER

SUBJECT: Request for Central Technical Authority (CTA) Interpretations

NPO requests your interpretation and positions on four specific items to support design for the Uranium Processing Facility (UPF) Project. Your interpretation will support ongoing design efforts and provide input for the next revision of the UPF Safety Design Strategy (SDS). The four items are discussed in more detail in the attached letter from Consolidated Nuclear Security, LLC (CNS). The UPF SDS was recently approved by NPO based on advice from the Chief of Defense Nuclear Safety to consider seismic design of the nuclear criticality safety structures, systems and components and, confinement ventilation system (Issues 1 and 4 in the attached letter). Issues 1, 2, and 3 were raised by the Peer Review Team for the UPF Project as items that need policy interpretation from the CTA.

If you have any questions, please contact Jim Goss of my staff at 865-574-4335.

Attachment

cc w/attachment:

C. Sykes, NA-511
D. Nichols, NA-50
K. Loll, NA-511
J. Roberson, NA-511
T. Driscoll, NA-193
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COR-NPO-10 NSE-3.23.2015-618668

COT-NNSA-YSO-PM-801768-A781

CNS | consolidated nuclear security, llc
PANTEX PLANT | Y-12 NATIONAL SECURITY COMPLEX

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Office 865.576.4209
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March 16, 2015

Mr. Kenneth A. Hoar
Assistant Manager
Nuclear Safety and Engineering
NNSA Production Office
Post Office Box 2050
Oak Ridge, Tennessee 37831-8009

Dear Mr. Hoar:

Contract DE-NA-0001942, Request for Formal Central Technical Authority (CTA) Guidance and Interpretation

References: 1) *IMA-PM-801768-A316, PEER Review Uranium Processing Facility (UPF) at the Y-12 National Security Complex, October 23, 2014*
2) *COT-NNSA-YSO-PM-A778, Contract DE-NA-0001942, Request for Formal Central Technical Authority (CTA) Guidance and Interpretation, March 4, 2015*
3) *RP-FS-801768-A003, Safety Design Strategy for the Uranium Processing Facility, Rev. 9, September 15, 2014*
4) *DCN-EF-801768-A040 to RP-FS-801768-A003, Safety Design Strategy for the Uranium Processing Facility, Rev. 9, September 30, 2014*

Consolidated Nuclear Security (CNS), Mission Engineering Design Authority requests NPO provide formal interpretation and guidance on the following topical areas for the Uranium Processing Facility (UPF) Project from the National Nuclear Security Administration (NNSA) Central Technical Authority (CTA. This letter supersedes COT-NNSA-YSO-PM-A778 dated March 4, 2015 (Ref. 2) to clarify requested information.

1 The UPF Project is using the informal interpretation of section 2.3.7 from DOE-STD-1020-2012 *Natural Phenomena Hazards Analysis and Design Criteria for DOE Facilities* as currently documented in the project UPF Safety Design Strategy (SDS) (Ref. 3 and 4) to determine the Natural Phenomena Hazard Design Category (NDC) for each of the UPF structures. The project requests a formal NNSA CTA interpretation to DOE-STD-1020-2012 in support of the project's current design efforts.

2 Attachment 2 to DOE Order 420.1C, Chapter I, Section 3(b)(11) cites the need to integrate design requirements from the various disciplines. Attachment 2, Chapter II, Section 3(c)(2)(b) requires automatic suppression throughout the facility. Attachment 2, Chapter III, Section 3(g) notes that NCS needs to provide firefighting guidance for moderation controlled areas. The UPF project intends on restricting or eliminating sprinkler coverage in certain moderation controlled areas to satisfy NCS requirements. Does this NCS control strategy meet DOE Order 420.1C or will an exemption be required?

Pen & Ink Change Made on 3/17/15
Reason For Change Corrected Document Number on Pg 2,3 and 4
Janice Smith 3/17/15
Janice Smith Date

CCN201574413

This document has been reviewed by a Y-12 DC/ UCNI-RO and has been determined to be UNCLASSIFIED and contains no UCNI. This review does not constitute clearance for Public Release.
Name: Kevin H. Reynolds Date: 3/16/2015

RC-UPF DMC 03-16-15P02:40 RCVD

3 Attachment 2 to DOE Order 420.1C, Chapter III, Section 3(f) requires the facility to be subcritical for all design basis events including NPH events. DOE-STD-1020-2012 states that an NDC-3 event is a credible event. However, Section 2.3.7 also states that a criticality accident is to be treated the same as any radiological event in accordance with DOE-STD-1189, Appendix A. For the UPF project, the dose consequences result in a SDC-2 design basis seismic event. The UPF project is interpreting DOE-STD-1020-2012, Section 2.3.7, to be that the "design basis event" for a NPH initiated criticality accident is defined by DOE-STD-1189-2008, Appendix A and that NCS SSCs are to be assessed against NDC-3 criteria for single contingency vulnerabilities that may necessitate a select number of SSCs to be assigned to NDC-3 (similar to a beyond design basis event except there is no cost benefit evaluation). Is the UPF project's interpretation correct or should all NCS NPH design basis events be NDC-3 events?

4 UPF follows the design objective that multiple layers of protection are used, as appropriate or necessary, according to the requirements of DOE O 420.1C, and DOE-STD-1189 to prevent or mitigate the unintended release of significant quantities of hazardous materials to the environment, including releases due to natural phenomena events. The UPF confinement strategy involves a series of DID physical barriers to prevent or mitigate the unintended release of radioactive materials to the environment. These barriers include some, or all, of the following:

- Storage containers and racks containing fissile material
- Process systems including tank systems containing uranium-bearing solutions
- Gloveboxes and hoods
- All building structural walls
- A multi-zone active confinement ventilation system (CVS) with high-efficiency particulate air (HEPA) filtration

Table A-1 in DOE G 420.1-1A, Appendix A contains "Ventilation System – General Criteria". One of the general design/performance criteria states that the "exhaust system should withstand anticipated normal, abnormal and accident system conditions and maintain confinement integrity". This criterion is shown as being applicable to both Safety Class and Safety Significant CVSs, and to active CVSs that only provide Defense-in-Depth (DID). However, additional CVS design/performance criteria contained in Table A-1 that specifically address "Resistance to Internal Events – Fire" and "Resistance to External Events – Natural Phenomena – Seismic" are shown as not applying to DID systems. The project's current interpretation of Table A.1 is that the general criterion is only applicable "as required to prevent accident release", and that the additional, more specific criteria qualify the degree of applicability. Is the UPF interpretation that the specific criteria in Table A.1 amplify the general criteria, correct?

The UPF interpretations noted above are considered consistent with the DOE Orders and Standards. However, the CTA confirmations of these positions are necessary to avoid time consuming debate about the UPF design. Therefore, the UPF project will continue developing the design using these interpretations until confirmation or clarification is received from the CTA.

CCN201574413

COT-NNSA-YSO-PM-801768-A~~778~~ 781 53-19-5

I can assist you with coordination of the requested CTA interpretations. I can be reached at (865) 576-4209.

Sincerely yours,

William R. Lonergan
Director, UPF Engineering Oversight & Authorization

WRL:jfs

c: S. C. Erhart, NPO Y-12
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CCN201574413